Biodiversity stabilizes ecosystems during climate extremes

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Credit: Wikipedia.

Can biodiversity help protect ecosystems from extreme conditions? That question is much on the minds of scientists and policy makers as a changing climate brings more wildly swinging conditions at the same time human activities reduce the number of species available to produce food and oxygen and help keep our planet in balance.

Now, a study of 46 grasslands in North America and Europe points to a promising answer: Increasing plant diversity decreases the extent to which extremely wet or dry conditions disrupt grassland productivity.

"We've long known that biodiversity has a stabilizing effect on productivity over time," said lead author Forest Isbell, principle investigator on the project and associate director for the University of Minnesota's Cedar Creek Ecosystem Science Reserve, one of the study sites. "But we haven't been quite sure whether that's during extreme events, after them, or both. This research showed that diverse communities are more stable because they exhibit resistance during extreme climate events."

The study, published in the online edition of the scientific journal *Nature* October 14, involved more than three dozen researchers from the U.S., Germany, the U.K., Ireland, France, Switzerland, the Netherlands, Czech Republic and Japan. The researchers began by classifying each year of each experiment on a five-point scale from extremely dry to extremely wet. They then measured corresponding productivity—basically, how much above-ground plant material each level of plant biodiversity produced each year.

Combining results across the 46 study sites, the researchers found that the higher the plant biodiversity, the lower the variability in productivity during wet or dry climate events. Overall, productivity of communities with only one or two species changed an average of 50 percent during events, while those with 16 to 32 species changed only half that much. Biodiversity did not, however, seem to strongly influence how quickly a site returned to normal productivity after wet or dry events.

Isbell, who is also an adjunct faculty member in the College of Biological Sciences, says the research team found the results somewhat unexpected. "Many of us were expecting that biodiversity would often

promote both resistance during climate events and resilience after climate events," he says. Instead, resistance to change clearly trumped resilience as the main mechanism through which biodiversity helps to preserve ecosystem stability in times of change.

Nico Eisenhauer, co-principle investigator on the project and professor at the German Centre for Integrative Biodiversity Research (iDiv) and Leipzig University, said the study, which was funded by iDiv's biodiversity synthesis center, "comprehensively shows that mankind is degrading the natural insurance of ecosystems." The findings, he said, improve our understanding of the role of biodiversity in helping nature weather the storms it faces.

"Researchers have been searching for decades for stabilizing ecosystem features," he said. "The present results bring the significance of biodiversity home to scientists, land managers and politicians as stabilizing agents of ecosystem services in the face of global change."

Co-author Dylan Craven, the postdoctoral researcher on the project, based at iDiv and Leipzig University, said, "A remaining challenge is to identify what factors, if not biodiversity, determine ecosystem recovery following extreme climate events."

Isbell added, "We also need to understand how biodiversity increases resistance during extreme climate events so we can determine what types of biodiversity are needed to help nature thrive under adverse circumstances."

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